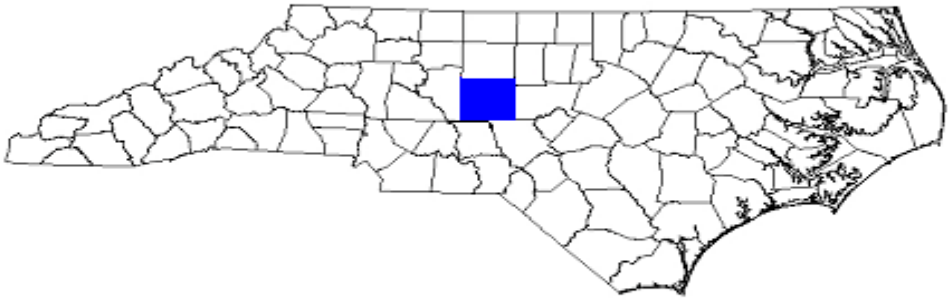
ANNUAL REPORT FOR 2004



Tulula Bog Stream Site
Graham County
Project No. 6.939004T
TIP No. A-9WM

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APPENDICIES

Summary

The following report summarizes the stream monitoring activities that have occurred during the Year 2004 at the Tulula Bog Site. The site is located in Graham County, North Carolina. The stream portion of the site is being monitored by UNC-A for NCDOT through a research grant. This report provides the monitoring results for the second documented year of monitoring (Year 2004).

The site was originally constructed in 2002. The Phase I portion of the site was planted in April 2002, while Phase II was planted in March 2003. UNC-A has split the stream monitoring into eight separate reaches (I, Ia, II, III, IV, Iva, V, Va). All documented information is being presented in this report. This includes profile and cross-sectional monitoring of each identified reach.

Per the letter from the Ecosystem Enhancement Program (EEP) to NCDOT dated August 25, 2004, the EEP has accepted the transfer of all off-site mitigation projects. The EEP will be responsible for fulfilling the remaining monitoring requirements and future remediation for this project.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2004 at the Tulula Bog Site. The stream portion of the site consists of 8,639 feet of restoration and 1,248 feet of preservation. The site was constructed in order to help replace highway-related impacts in the mountain region. The site is located off of Highway 129 between Topton and Robbinsville.

1.2 Project History

July 2000	Monitoring Gauges Installed
April 2002	Phase I Planted
March 2003	Phase II Planted
March - November 2003	Hydrologic Monitoring (1 yr.)
September 2003	Vegetation Monitoring (1 yr.)
March - November 2004	Hydrologic Monitoring (2 yr.)
July 2004	Vegetation Monitoring (2 yr.)
November 2004	Four Additional Plots Set and Counted

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The success criteria, as defined by both USACE and DWQ permit conditions reference the August 2000 mitigation plan (Appendix B) and specific 401 conditions (Appendix C). These conditions require channel stability analysis and reference photos. Pre and post construction benthic monitoring was conducted and submitted to the regulatory agencies for review.

Natural streams are dynamic systems that are in a constant state of change. Longitudinal profile and cross section surveys will differ from year to year based on changes in the watershed. Natural channel stability is achieved by allowing the stream to develop a proper dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades

nor degrades. A stable stream consistently transports its sediment load, both in size and type, associated with local deposition and scour. Channel instability occurs when the scouring process leads to degradation, or excessive sediment deposition results in aggradation (Rosgen, 1996). The following surveys were conducted in support of the monitoring assessment:

- Longitudinal Profile Survey. This survey addressed the overall slope of the reach, as well as slopes between bed features. The bed features are secondary delineative criteria describing channel configuration in terms of riffle/pools, rapids, step/pools, cascades and convergence/divergence features which are inferred from channel plan form and gradient. The surveys are compared on a yearly basis to note and/or compare aggradation, degradation, head cuts, and areas of mass wasting. The longitudinal profile is expected to change from year to year. Significant changes may require additional monitoring.
- Cross Section Surveys. These surveys addressed the following characteristics at various locations along the reach: entrenchment ratio, width/depth ratio, and dominant channel materials. The entrenchment ratio is a computed index value used to describe the degree of vertical containment. The width/depth ratio is an index value that indicates the shape of the channel cross section. The dominant channel materials refer to a selected size index value, the D50, representing the most prevalent of one of six channel material types or size categories, as determined from a channel material size distribution index.

2.2 Stream Description

The proposed design for Tulula Bog was an E4 stream type according to the Rosgen Classification of Natural Rivers. Prior to construction, the channel was incised below the historic stream grade and was straightened. A total of 32 cross sections were established and surveyed along the stream.

Table 1. Abbreviated Morphological Summary Tulula Bog Site

Variable		*See Appendix A Reach Data for Cross Section Monitoring Results* Proposed Design Range		Year 1	Year 2	Year 3	Year 4	Year 5
Drainage Area (mi^2)		2.41						
Bankfull Width (ft)	Mean	8.0 - 10.0						
Bankfull Mean Depth (ft)	Mean	1.6 - 2.9						
Width/Depth Ratio	Mean	3.1 - 6.3						
Bankfull Cross Sectional Area (ft^2)	Mean	15 - 20						
Maximum Bankfull Depth (ft)	Mean	2.2 - 5.3						
Width of Floodprone Area (ft)	Mean	290 - 480						
Entrenchment Ratio	Mean	31 - 64						
Slope		0.0017 - 0.002						
Particle Sizes (Riffle Sections)								
D_{16} (mm)		0.25 - 0.50						
D_{35} (mm)		0.50 - 1.0						
D_{50} (mm)		1.0 - 2.0						
D_{84} (mm)		5.0 - 8.0						
D_{95} (mm)		N/A						

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of four total cross sections associated with each reach, as well as the longitudinal profiles. Cross section locations were established by UNC-A and consist of two riffles and two pools for each reach. Approximately 2,000 linear feet of channel was surveyed along Tulula Creek. Benchmark stakes were installed on both the left and right stream banks for each cross section location. Pebble counts were also taken for each reach. Due to construction methods water was released in different reaches at different times. These dates are shown below.

- Reach I. Water released on September 11, 2001
  Profile data (2001, 2002, and 2004)
  Cross-section data (2001, 2002, 2003, and 2004)
  Pebble count data (2003 and 2004)

- Reach Ia. Water released on September 11, 2001
  Profile data (2001, early 2002, late 2002, 2003, and 2004)

Cross-section data (2001, 2002, 2003, and 2004)
Pebble count data (2003 and 2004)

- Reach II. Water released on October 16, 2001
  Profile data (2001, early 2002, late 2002, 2003, and 2004)
  Cross-section data (2001, 2002, 2003, and 2004)
  Pebble count data (2003 and 2004)

- Reach III. Water released on October 16, 2001
  Profile data (2001, early 2002, late 2002, 2003, and 2004)
  Cross-section data (2001, 2002, 2003, and 2004)
  Pebble count data (2003 and 2004)

- Reach IV. Water released on November 14, 2001
  Profile data (2001, early 2002, late 2002, 2003, and 2004)
  Cross-section data (2001, 2002, 2003, and 2004)
  Pebble count data (2003 and 2004)

- Reach IVa. Water released on November 14, 2001
  Profile data (2001, early 2002, late 2002, and 2004)
  Cross-section data (2001, 2002, 2003, and 2004)
  Pebble count data (2004)

- Reach V. Water released on May 27, 2002
  Profile data (2002, 2003, and 2004)
  Cross-section data (2002, 2003, and 2004)
  Pebble count data (2004)

- Reach Va. Water released on June 25, 2002
  Profile data (2004)
  Cross-section data (2002 and 2004)
  Pebble count data (2004)

The cross sections established during the monitoring survey are currently being monitored to determine the actual extent of aggradation or degradation. All of the cross section locations appeared stable with little or no active bank erosion. Some degradation was noted during initial water release but cross sections remain stable from 2003 to 2004. Longitudinal profile data has also been collected for each reach. Survey data collected during each monitoring periods may vary depending on actual location of rod placement and alignment; however, this information should remain similar in overall appearance. Longitudinal surveys, cross section comparisons, and pebble count comparisons are presented in Appendix A.

Pebble counts were taken as a means to determine the composition of bed material during the monitoring period. This data is presented within each reach.

The movement of some reaches to finer materials may be a result of beaver activity within the site.

2.4 Conclusions

Overall, Tulula Creek remains stable. Areas of initial degradation exist along each stream reach; however, these areas seem to have stabilized. Localized areas of sloughing and erosion do exist, however work associated with corrective actions would likely cause more sedimentation than actual benefit at the current time. Beaver activity within the site is contributing to some localized stability problems. Beaver control activities are currently ongoing within the site.

The EEP will work with UNC-A to monitor stream stability monitoring at the Tulula Creek Mitigation Site in 2005.